State of Hawaii
Department of Health

Child and Adolescent
Mental Health Division

Child Status Measurement: Operating Characteristics of the CALOCUS and CAFAS

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Abstract

Examined the temporal stability, concurrent, predictive and incremental validity of the Child and Adolescent Level of Care Utilization System (CALOCUS) and Child and Adolescent Functional Assessment Scale (CAFAS) in a sample of 3,305 youth who completed one or more valid CALOCUS assessments during the period from July 1, 2000 to June 30, 2003. Findings indicated that both the CALOCUS and the CAFAS yielded relatively stable scores over short periods and that stability decreased in a generally linear fashion as the time lag between measurements increased. Results generally supported the concurrent and predictive validity of these measures in relation to each other and in relation to service utilization and cost variables. The CAFAS and CALOCUS provided both common and unique information. The CAFAS uniquely contributed to the prediction of service intensity (e.g., total service hours), whereas the CALOCUS made a unique contribution to the prediction of service restrictiveness (e.g., proportion of service hours provided in out-of-home settings), and both the CAFAS and the CALOCUS made independent unique contributions to the prediction of future service costs. These findings support the use of the CAFAS and CALOCUS within the CAMHD service array.

Introduction

The Child and Adolescent Level of Care Utilization System (CALOCUS; American Academy of Child and Adolescent Psychiatry, 1999) was developed as a tool to aid treatment teams in understanding youth and family service needs and in selecting a treatment setting appropriate to those needs. The CALOCUS requires clinicians to make dimensional ratings on a five-point scale in the domains of risk of harm, functional status, comorbidity, environmental stress, environmental support, resiliency and treatment history, child treatment acceptance and engagement, and parent treatment acceptance and engagement. These ratings may be summed to yield a total score, but are also combined through a detailed algorithm into a level of care judgment. The seven level of care categories are basic services (Level 0), recovery maintenance and health management (Level 1), outpatient services (Level 2), intensive outpatient services (Level 3), intensive integrated service without 24-hour medical monitoring (Level 4), non-secure, 24-hour, medically monitored services (Level 5), and secure, 24-hour, medically managed services (Level 6).

The Child and Adolescent Functional Assessment Scale (CAFAS; Hodges, 1995) is a 200-item clinician report scale that measures level of functional impairment. Based on their knowledge and experience with the child, raters review behavioral descriptions ordered by level of impairment within eight domains of functioning. The subscales of School Role Performance, Home Role Performance, Community Role Performance, Behavior Toward Others, Mood/Emotions, Mood/Self-Harmful Behavior, Substance Use, and Thinking are calculated by scoring the highest level of impairment (i.e., severe = 30, moderate = 20, mild = 10, no/minimal = 0) endorsed within the respective domain of items.

Although several studies have described the psychometric properties of the CAFAS (e.g., Hodges & Wong, 1995), limited public information is available regarding the operating characteristics of the CALOCUS. The initial field trial of the CALOCUS (Fallon & Pumariega, 2001) included analysis of the inter-rater reliability of the CALOCUS ratings, and the concurrent correlations of the CALOCUS with the Child Global Assessment Scale (CGAS) and the Child and Adolescent Functional Assessment Scale (CAFAS; Hodges, 1998). Results indicated that intrajudge agreement based on clinical vignettes ranged from ICC (2, 2) = .57 - .95 across scales, with all scales above .70 except for environmental stress and child treatment acceptance and engagement. Preliminary validity analysis found that the CALOCUS total score correlated -.33 with the Child Global Assessment of Scale (CGAS) and .62 with the CAFAS eight-scale total score.

The Hawaii Department of Health Child and Adolescent Mental Health Division (CAMHD) participated as a research site as part of the initial field-testing of the CALOCUS instrument (Fallon & Pumariega, 2001). Through this involvement, clinical personnel from CAMHD participated in training provided by the CALOCUS developers. Since this initial project, CAMHD has maintained an ongoing training and certification program to promote high quality performance of outcome assessments. Care coordinators and other personnel using the CALOCUS and other outcome assessments, such as the CAFAS, complete certification training and meet administration standards on at least an annual basis.

The purpose of the present study was to analyze the basic operating characteristics of the CALOCUS and CAFAS as they have been used in standard practice within the CAMHD system of care. Three years of data from July 1, 2000 to June 30, 2003 were included in the present study. This study analyzed the concurrent, predictive, and incremental validity of the CALOCUS and CAFAS in relation to each other and in relation to service intensity (i.e., total hours of service), service restrictiveness, proportion of service hours provided in out-of-home settings, and total cost. Higher scores on the CALOCUS and CAFAS, which indicate a more intensive level of service needs and more problematic functioning, were expected to positively correlate with each other scores and the various measures of service intensity and restrictiveness. Service expenditures were also selected as a global proxy variable for service utilization because total costs are affected by the intensity, duration, and restrictiveness of services provided.

Method

Participants

Participants for this study included all youth who were registered with CAMHD for one or more days and received one or more valid CALOCUS assessments during the period from July 1, 2000 to June 30, 2003. Specifically, 3,305 youth received one or more CALOCUS assessments during the period. These youth received a total of 8,888 CALOCUS assessments, averaging 2.9 assessments per youth (SD = 2.1, Max = 12). In addition, 2,825 youth (93%) also received one or more CAFAS assessments (N = 9,544, M = 3.1, SD = 2.3, Max = 11) during the same period. The demographic, diagnostic, and service characteristics of the subgroup with a CAFAS assessment were nearly identical to the total sample (see Table 1).

Participants in the sample ranged in age from 3 to 21 years, with a mean of 12.7 years (SD = 3.8 years). The age distribution was negatively skewed with adolescents disproportionately represented over younger children (see Figure 1). Approximately two-thirds of the sample was male. The most common ethnic groups represented were Multiethnic (28%), Native Hawaiian or Other Pacific Islander (26%), White (25%), and Asian (16%). The sample was broadly geographically distributed across the regional family guidance centers with the big island of Hawaii accounting for the largest proportion and Kauai accounting for the smallest proportion of youth. As expected given the differences in organizational structure between the regional family guidance centers and the Family Court Liaison Branch (FCLB), only a small proportion of the sample had been most recently registered to FCLB.

Figure 1. Age Distribution of Total Sample.
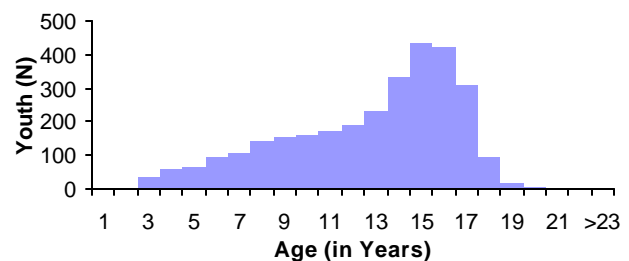
The four most common primary diagnoses of disruptive behavior, attentional, mood, and pervasive developmental disorders accounted for nearly three-quarters of the total sample. Approximately two-thirds of youth had comorbid diagnoses with an average of 1.9 diagnoses per youth. When both primary and comorbid diagnoses were considered, disruptive behavior, attentional, and mood disorders remained the most common categories but the ranking of the other diagnostic groups differed from that for primary diagnoses only.

Participants in the present study received a range of mental health services. Approximately, one-third of youth received services in an out-of-home placement during the study period. Over one-half received intensive outpatient services and roughly five-sixths received at least one less intensive outpatient service during the period. When interpreting the results from this sample, it is important to bear in mind that CAMHD underwent major reorganization during the study period. Less intensive outpatient services were transferred to the Department of Education's School Based Behavioral Health program, as were services for youth with Pervasive Developmental Disorders. These transitions coincided with both a major reduction in the overall population size and a change in the array of services provided. To provide the broadest possible range of population and services for analysis of the CALOCUS, all youth were included in this study. However, the results of this study should be interpreted as over-representing intensive mental health services and under-representing less intensive services compared to when the system provided the full continuum of care.

Table 1. Demographics of Final Sample.

	CALOCUS (N = 3,305)	CALOCUS & CAFAS (N = 2,825)
Youth (N)	3,305	2,825
Age (in Years at First Assessment)		
Mean	12.7	12.9
SD	3.8	3.6
Minimum	3	3
Maximum	21	21
Gender (% of Youth)		
Females	31	31
Males	69	69
Ethnicity (% of Youth Available)		
Multiethnic	28.0	28.4
Native Hawaiian or Pacific Islander	25.9	26.1
White	24.5	23.7
Asian	16.4	16.5
Black or African American	3.0	3.0
Hispanic or Latino	1.8	1.9
American Indian and Alaska Native	0.4	0.4
Ethnicity Not Available (% of Youth)	23.0	22.6

Table 1 (continued). <u>Demographics of Final Sample.</u>

	Any CALOCUS (N = 3,305)	CALOCUS & CAFAS (N = 2,825)
Most Recent Family Guidance Center (% of Youth)		
Hawaii (Big Island)	23.7	24.1
Honolulu Oahu	14.8	15.3
Central Oahu	12.7	12.7
Windward Oahu	11.5	10.8
Maui	11.4	11.9
Leeward Oahu	10.5	11.1
Kauai	4.9	4.8
Family Court Liaison Branch	0.5	0.6
Primary Diagnosis (% of Youth Available)		
Disruptive Behavior	21.8	22.3
Attentional	19.9	19.9
Mood	18.4	18.7
Pervasive Developmental	13.5	12.5
Adjustment	8.2	8.1
Anxiety	7.6	7.8
Miscellaneous	5.8	5.7
Substance-Related	3.2	3.2
Psychotic Spectrum	1.2	1.3
None Recorded	0.3	0.3
Mental Retardation	0.1	0.1
Multiple Diagnoses (% of Youth)	63.6	64.2
Number of Diagnoses (Mean)	1.9	2.0
Any Diagnosis Of (% of Youth Available)		
Disruptive Behavior	40.5	41.3
Attentional	33.8	34.1
Mood	28.1	28.6
Miscellaneous	24.1	23.9
Anxiety	14.0	14.3
Pervasive Developmental	14.0	13.0
Substance-Related	12.9	13.1
Adjustment	11.7	11.6
Mental Retardation	5.0	5.1
Psychotic Spectrum	1.7	1.9

Table 1 (continued). <u>Demographics of Final Sample.</u>

	Any CALOCUS (N = 3,305)	CALOCUS & CAFAS (N = 2,825)
Any Services Procured During Study Period (% of Youth)		
Out-of-State	1.7	1.8
Hospital Residential	8.2	8.5
Community High Risk	1.1	1.2
Community Residential	16.7	17.4
Therapeutic Group Home	11.1	11.7
Therapeutic Family Home	12.1	12.7
Respite Home	0.1	0.0
Intensive Day Stabilization	0.4	0.4
Partial Hospitalization	2.8	2.9
Multisystemic Therapy	23.2	24.4
Intensive In-Home	56.4	56.7
Flex	26.8	27.9
Respite	12.1	12.0
Less Intensive	82.0	81.8
Any Out-of-Home Service Procured During Study Period (% of Youth)	35	37%
Med-Quest Involvement (% of Youth)		
Med-Quest	19.6	20.8
Non-Quest	80.4	79.2

The characteristics of the sample for this study were generally representative of the overall CAMHD population during the study period, but relative to the general population of youth in Hawaii, adolescent, male, Native Hawaiian or Other Pacific Islander, and White youth were over-represented whereas Multiethnic, Asian, and Hispanic youth were underrepresented (see Daleiden, 2003).

<u>Materials</u>

<u>Child and Adolescent Functional Assessment Scale</u> (CAFAS; Hodges, 1998). The CAFAS is a 200-item clinician report scale that measures level of functional impairment. Based on their knowledge and experience with the child, raters review behavioral descriptions ordered by level of impairment within eight domains of functioning. The subscales of School Role Performance, Home Role Performance, Community Role Performance, Behavior Toward Others, Mood/Emotions, Mood/Self-Harmful Behavior, Substance Use, and Thinking are calculated by scoring the highest level of impairment (i.e., severe = 30, moderate = 20, mild = 10, no/minimal = 0) endorsed within the respective domain of items. An eight-scale total score is calculated by summing across the eight subscales, whereas a five-scale total is calculated by

summing the raw scores from behavior, substance use, and thinking scales with the maximum score from the school, home, and community role performance scales and with the maximum score from the emotions and self-harm. The CAFAS has been found to have acceptable internal consistency across items, inter-rater reliability across sites, and stability across time (Hodges, 1995; Hodges & Wong, 1996). Studies of concurrent validity have found that CAFAS scores are related to severity of psychiatric diagnosis, intensity of care provided, restrictiveness of living settings, juvenile justice involvement, social relationship difficulties, school-related problems, and risk factors. Studies of predictive validity have found that CAFAS scores from intake assessments predict service utilization and cost for services. Care coordinators served as the primary raters for the CAFAS and results were entered directly into a networked computer scoring program by care coordinators or statistics clerks.

Child and Adolescent Level of Care Utilization System (CALOCUS; American Academy of Child and Adolescent Psychiatry, 1999). The CALOCUS is a clinician rating form. Clinicians make dimensional ratings on a five-point scale in the domains of risk of harm, functional status, comorbidity, environmental stress, environmental support, resiliency and treatment history, child treatment acceptance and engagement, and parent treatment acceptance and engagement. These ratings may be summed to yield a total score, but are also combined through a detailed algorithm into a level of care judgment into one of seven categories: basic services (Level 0), recovery maintenance and health management (Level 1), outpatient services (Level 2), intensive outpatient services (Level 3), intensive integrated service without 24-hour medical monitoring (Level 4), non-secure, 24-hour, medically monitored services (Level 5), and secure, 24-hour, medically managed services (Level 6). Preliminary reliability (Fallon & Pumariega, 2001) indicated that intrajudge agreement based on clinical vignettes ranged from ICC $(2,2) = .57 - .95$ across scales with all scales above .70 except for environmental stress and child treatment acceptance and engagement. Preliminary validity analysis found that the CALOCUS total score correlated -.33 with the Child Global Assessment of Scale (CGAS) and .62 with the CAFAS eight-scale total score. Care coordinators served as the primary raters for the CALOCUS and results were entered directly into a networked computer scoring program by care coordinators or statistics clerks.

Child and Adolescent Mental Health Information System (CAMHMIS) Fields. Information was gathered and entered into CAMHMIS through the standard operating procedures of the regional family guidance centers. Generally, care coordinators were responsible for gathering data from families and professionals and for organizing completion of child status measures on a quarterly basis. Detailed information about the structure of the CAMHMIS database is beyond the scope of the present report. The definition of variables calculated for the present analyses are as follows.

Out-of-Home Services included out-of-state, acute inpatient, hospital residential, community high risk residential, community residential, therapeutic group home, and therapeutic foster home services. Services, regardless of type, that were provided to youth while detained or incarcerated were considered out-of-home services.

Receipt of Services was calculated based on records that were accepted as payable during billing adjudication for the hospital residential, community residential, therapeutic

group home, therapeutic foster home, respite home, intensive day stabilization, intensive in-home, and less intensive levels of care. Service information for the out-of-state, community high risk, multisystemic therapy, flex, and respite was based on the CAMHMIS service authorization database augmented by information based on manual billings collected by the Fiscal Office and weekly provider census data collected by the Clinical Services Office. A youth was identified as receiving a service if there was a record of payment for the service on at least one day during the reporting period. Thus, the service receipt counts are unduplicated within a level of care, but are duplicated across levels of care. For example a youth who received one month of hospital residential and two months of intensive in-home services would be recorded as receiving both of these levels of care during the reporting period.

Service Intensity was defined as the number of service hours per reporting period. Service units were recorded in CAMHMIS as 15-minute units for home and community services and daily units for out-of-home services. To create a relatively comparable metric across levels of care, daily out-of-home services were converted to hours at a rate of 6.5 hours per day. Because daily utilization of multisystemic therapy was not recorded for fiscal years 2001 to 2002, hours of service were allocated based on the practice standard formula of 80 hours during the first month of service, 40 hours during the second month, and 20 hours for subsequent months.

Service Restrictiveness was defined as an ordinal variable ranging from (1) Case Management, (2) Less Intensive Outpatient (assessment, consultation, and treatment services), (3) Intensive Home and Community Based (intensive home, school, or community services, multisystemic therapy), (4) Day Treatment (biopsychosocial rehabilitation, day treatment, partial hospitalization, intensive day stabilization), (5) Family Home (therapeutic foster home), (6) Community Out-of-Home (therapeutic group home, community-based residential) and (7) Most Restrictive (community high risk residential, hospital residential, acute inpatient, out-of-state, detained or incarcerated).

Total Cost of Services was the sum of all service expenditures (US$) recorded during the reporting period.

Procedures

Both the CALOCUS and CAFAS assessments were expected to be completed quarterly by the care coordinators managing each case. Psychiatrists or clinical psychologists also administered the CALOCUS and CAFAS on an as-needed basis or in conjunction with mental health evaluations. To provide timely feedback, promote data accuracy, and facilitate clinical use of these assessments, CAMHD maintains an on-demand clinical reporting system that provides a complete historical record of service and child status information in a user-friendly graphical format.

Pearson correlations were calculated between CALOCUS scales and continuous criterion measures (i.e., CAFAS scales, total cost, total service hours, and proportion of out-of-home

service hours). Spearman correlations were calculated between CALOCUS and CAFAS scales with ordinal measures (i.e., service restrictiveness). In accord with the quarterly administrations of the CALOCUS and CAFAS measures, the fiscal quarter was defined as the fundamental unit of time for analysis. Thus concurrent relations are defined as the association between CALOCUS scores obtained during a quarter with CAFAS scores obtained during that same quarter and service variables calculated as the aggregate of all days during that quarter. Therefore, concurrent measures do not necessarily represent measures completed on the same day and in fact may represent measurements up to 90 days apart. Predictive measures were completed in different fiscal quarters.

Because 12 fiscal quarters were included in the study period, 12 samples were available for concurrent correlations. Although each of these samples consisted of unique cases, they were overlapping to the extent that some youth received multiple assessments in each quarter. Therefore the samples were not statistically independent. Average correlations calculated using Fischer r to z' transformations across these 12 samples were reported to maximize use of all available data. These averages and their standard errors provide an indication of the consistency of the correlations across samples, but due to their non-independence, they should not be interpreted as 12 full replications of the analysis.

For the predictive analyses, as the quarterly lag increased, the number of available samples decreased. Thus, correlations between CALOCUS scales and criterion measures completed during the subsequent quarter (i.e., a one quarter lag) allowed for aggregation across 11 quarterly samples. Correlations between CALOCUS scales and criterion measures completed two fiscal quarters later (i.e., a two quarter lag) allowed for aggregation across 10 quarterly samples. This reduction in number of samples and sample sizes was expected to lead to larger standard errors as the length of the prediction interval increases.

Incremental validity analyses were performed using hierarchical multiple regression. Total service hours, proportion of out-of-home service hours, and total costs were included as dependent variables in separate analyses. Service restrictiveness was not analyzed due to its ordinal measurement properties. Youth gender and age were entered as independent variables at the first step of the hierarchy and were followed by the addition of the CALOCUS and CAFAS total scores at the second step.

Results

Temporal Stability

Correlation coefficients were calculated between the CALOCUS scales and the CAFAS scales at different administrations. A simplex model describing generally linear decline in the average stability coefficients was evident as the lag between measurements increased, except for the CAFAS substance use scale. Table 2 presents the average stability coefficient for a one-quarter lag between assessments along with the slope and intercept for predicting stability coefficients at longer quarterly lags. These analyses found that both the CALOCUS and the CAFAS yielded relatively stable scores over short periods and that stability decreased as the time between measurements increased. As expected from psychometric theory, total scales were more

Table 2. One-quarter stability coefficients and linear model for predicting coefficients for larger quarterly time lags.

Scale	Stability (r_1)	Slope	Intercept	R^2	p
CALOCUS					
Total	.71	-.05	.65	.92	< .001
Level of Care	.63	-.04	.57	.81	< .001
Comorbidity	.64	-.04	.56	.80	< .001
Environmental Stress	.56	-.06	.56	.97	< .001
Environmental Support	.58	-.07	.61	.88	< .001
Functional Status	.59	-.04	.51	.85	< .001
Resiliency	.53	-.04	.49	.87	< .001
Risk of Harm	.61	-.05	.57	.92	< .001
Child Treatment Acceptance	.54	-.05	.53	.93	< .001
Parent Treatment Acceptance	.54	-.06	.60	.88	< .001
CAFAS					
8-Scale Total	.67	-.04	.62	.89	< .001
Behavior Toward Others	.58	-.03	.48	.60	.005
Substance Use	.69	-.01	.52	.08	n.s
Thinking	.73	-.05	.76	.97	< .001
Moods Composite	.50	-.04	.52	.85	< .001
Emotions	.49	-.04	.51	.92	< .001
Self-Harm	.44	-.03	.43	.84	< .001
Role Performance Composite	.61	-.05	.55	.86	< .001
Home	.58	-.04	.51	.83	< .001
School	.58	-.04	-.50	.79	< .001
Community	.77	-.04	.76	.90	< .001
Family Social Support Primary	.61	-.06	.62	.93	< .001
Material Needs Primary	.61	-.06	.62	.93	< .001

Note: The CAFAS substance use scale was better described by a quadratic U-shaped curve of form $y = .01 x^2 + .15 x + .93$, $R^2 = .82$.

Table 3. Average correlations between the CALOCUS and CAFAS scales completed within the same fiscal quarter.

CALOCUS	CAFAS										
	Total	Behavior Toward Others	Substance Use	Thinking	Emotions	Self-Harm	Home Role	School Role	Community Role	Social Support Primary	Material Needs Primary
Total	.66	.43	.37	.14	.31	.26	.44	.42	.27	.00	.23
Level of Care	.64	.45	.28	.22	.35	.25	.50	.47	.31	.00	.18
Comorbidity	.42	.22	.31	.28	.18	.18	.29	.25	.15	-.06	.06
Environmental Stress	.36	.22	.24	-.06	.17	.09	.29	.25	.33	.00	.27
Environmental Support	.27	.17	.21	-.08	.12	.07	.23	.22	.25	.00	.32
Functional Status	.56	.45	.17	.28	.35	.23	.41	.45	.18	.03	.06
Resiliency	.52	.39	.22	.13	.29	.18	.41	.41	.26	-.03	.10
Risk of Harm	.57	.43	.23	.23	.29	.30	.44	.36	.27	.05	.07
Child Treatment Acceptance	.44	.33	.23	.11	.24	.11	.33	.33	.23	-.02	.07
Parent Treatment Acceptance	.18	.12	.13	-.08	.08	.05	.14	.14	.17	. 01	.26

generally stable than subscales. The CALOCUS total scale demonstrated somewhat greater temporal stability than the level of care judgment.

Although these coefficients describe the stability of the CALOCUS and CAFAS in operation, they are not true test-retest reliability coefficients. Because youth were actively receiving treatment, substantive changes are expected in levels of functioning and service needs. This would tend to bias stability estimates toward underestimates of true reliability. On the other hand, youth with significant improvements in functioning were likely to be discharged from the system, so that youth remaining in the longer-term samples were likely to have more stable functioning.

Concurrent Validity

Concurrent validity was examined by calculating correlation coefficients between the CALOCUS scales and the CAFAS scales for measures completed during the same fiscal quarters (see Table 3). Consistent with the results of the initial field trial ($r = .62$; Fallon & Pumariega, 2001), the average correlation between the CALOCUS total score and the CAFAS 8-scale total score was .66 ($r_{SD} = .05$, Range = .60 - .73, N = 6,890, $N_{Mean} = 574$, $N_{SD} = 206$). Similar results were evident when the CALOCUS level of care scale was examined ($r_{Mean} = .64$, $r_{SD} = .05$, Range = .60 - .70, N = 6,950, $N_{Mean} = 579$, $N_{SD} = 207$). The magnitude of these concurrent correlations across measures approximated the one-quarter stability estimates within these scales over time.

As expected based on psychometric theory, the CAFAS total score correlated more highly with these CALOCUS global scores than with the other CALOCUS subscales. Further, examination of the CALOCUS subscales revealed that the highest

Table 4. Average correlations between the CALOCUS scales and service variables measured within the same fiscal quarter.

	Service Variables			
CALOCUS	Total Service Hours	Proportion Out-of-Home	Service Restrictiveness	Total Cost
Total	.00	.22	.21	.23
Level of Care	.05	.18	.20	.22
Comorbidity	.09	.09	.11	.14
Environmental Stress	-.11	.19	.14	.11
Environmental Support	-.10	.11	.08	.08
Functional Status	.09	.10	.14	.17
Resiliency	-.01	.15	.15	.15
Risk of Harm	.07	.18	.17	.22
Child Treatment Acceptance	-.01	.11	.11	.10
Parent Treatment Acceptance	-.10	.10	.06	.09

correlation for each subscale was with the CAFAS 8-scale total score, except for the CALOCUS Environmental Support subscale which correlated most highly with the CAFAS Primary Caregiver Material Needs subscale. All CALOCUS subscales yielded at least one average convergent correlation greater than .30 except for the Parent Treatment Acceptance and Engagement scale, which yielded a maximum average correlation of .26. Seven of the 10 CAFAS subscales yielded at least one average convergent correlation greater than .30, those that did not were the Thinking (r_{max} = .28), Self-Harm (r_{max} = .26), and Primary Caregiver Social Support (r_{max} = .05) scales.

Small but significant correlations were also evident between the CALOCUS total score and measures of total cost (r_{Mean} = .23, r_{SD} = .05, Range = .16 - .28, N = 7,503, N_{Mean} = 625, N_{SD} = 192), service restrictiveness (r_{Mean} = .21, r_{SD} = .06, Range = .15 - .36, N = 8,836, N_{Mean} = 736, N_{SD} = 226), and proportion of out-of-home service hours (r_{Mean} = .22, r_{SD} = .05, Range = .14 - .31, N = 7,191, N_{Mean} = 599, N_{SD} = 183), but not with total number of service hours (r_{Mean} = .00, r_{SD} = .06, Range = -.06 - .19, N = 8,888, N_{Mean} = 741, N_{SD} = 228). Similar average correlations were obtained between the CALOCUS level of care scale and total cost (r_{Mean} = .22, r_{SD} = .04), service restrictiveness (r_{Mean} = .20, r_{SD} = .05), proportion of out-of-home service hours (r_{Mean} = .18, r_{SD} = .04), and total number of service hours (r_{Mean} = .05, r_{SD} = .06). Of all the subscales, risk of harm subscale tended to be the most strongly correlated with the service variables.

Analysis of the CAFAS found small but significant correlations between the CAFAS 8-scale total score and each of the service measures (see Table 5). However, the CAFAS Home Role Performance subscale was more highly related with the service variables than the total score, and the Community Role Performance subscale

Table 5. Average correlations between the CAFAS scales and service variables measured within the same fiscal quarter.

CAFAS	Service Variables			
	Total Service Hours	Proportion Out-of-Home	Service Restrictiveness	Total Cost
8-Scale Total	.18	.18	.23	.23
Behavior Toward Others	.14	.10	.18	.15
Substance Use	-.05	.13	.06	.02
Thinking	.17	-.07	.09	.11
Emotions	.09	.03	.13	.08
Self-Harm	.08	.05	.11	.11
Home	.25	.25	.26	.27
School	-.01	-.02	.06	.05
Community	.12	.31	.16	.22
Material Needs	.03	.09	.03	.05
Social Support	.01	.03	-.02	.02

yielded the highest correlation with proportion of service hours provided in an out-of-home setting.

Taken together, these findings demonstrate a moderate degree of convergence between the CALOCUS and CAFAS scores that approximates their one-quarter stability coefficients. Stated differently, if the CAFAS and CALOCUS are conceptualized as alternate forms of the same measurement, then the alternate form reliability is roughly the same as the test-retest stability of the individual forms. Therefore, these instruments appeared to measure a considerable amount of overlapping content. However, the patterned variability of the subscale correlations indicated that the CALOCUS and CAFAS contents were not completely interchangeable.

The CALOCUS also demonstrated mild convergent correlations with service variables, suggesting that clinician judgments of child needs were related to the type and cost of services received. Convergent service correlations were expected to be somewhat lower than short-term predictive correlations because information from the CALOCUS assessment would not have had sufficient opportunity to affect clinical decision-making regarding services.
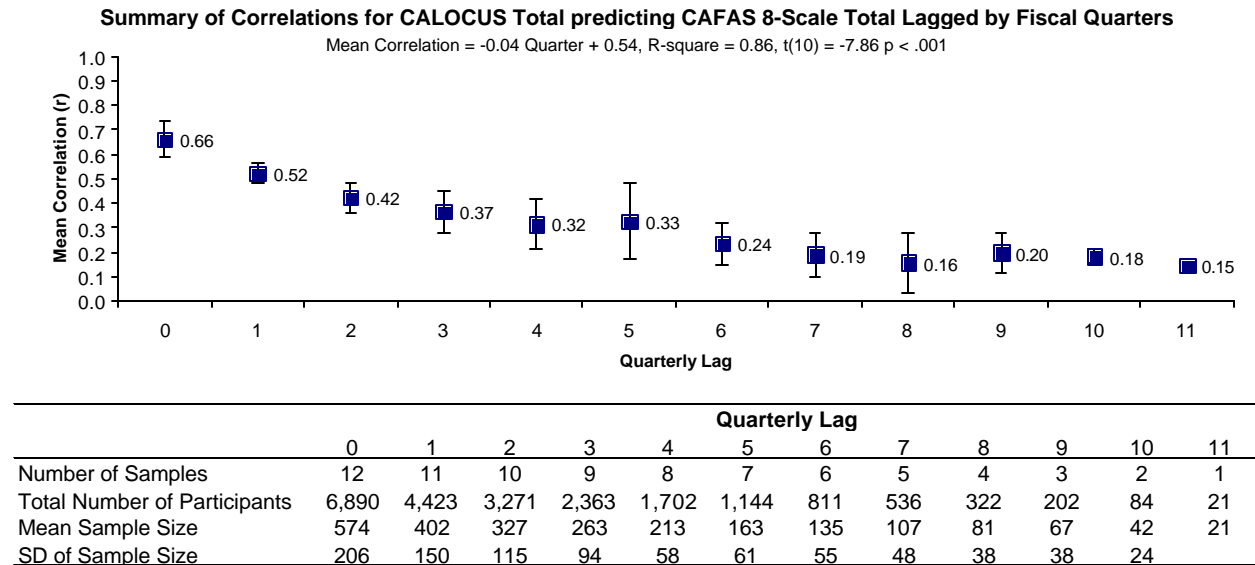
Predictive Validity

The results of the predictive correlation analyses were generally consistent with the convergent correlations. The predictive validity coefficients were roughly symmetric when examined for CALOCUS scores predicting subsequent CAFAS scores, and for CAFAS scores predicting subsequent CALOCUS scores. Therefore, to simplify reporting, only the analyses of CALOCUS scores predicting subsequent CAFAS scores are reported here. One of two patterns tended to emerge with increasing prediction intervals. The most common pattern was that the average validity coefficients described a generally linear decline in magnitude as the lag between predictor and criterion measures increased. The other less prevalent pattern was the small magnitude correlations were evident and remained stable over time (i.e., coefficients fluctuate at or near zero).

Figure 1 illustrates the first pattern by depicting the average correlations between the CALOCUS total score with the CAFAS 8-scale total score for each of the 12 quarterly lags analyzed. The observed one-quarter predictive validity coefficient was .52 with a standard deviation of .07 in coefficients across the 11 samples included. The predictive coefficient describing the correlation between CALOCUS scores with CAFAS scores administered four quarters later was .32, whereas the ten-quarter predictive coefficient was .18. Examination of the linear decrease in these coefficients indicated that, on average, the predictive validity coefficient decreased by .04 units per one unit increase in quarterly lag.

Due to the consistency in the linear trends across the numerous CALOCUS and CAFAS scales analyzed, only the average correlation matrix for one-quarter predictive validity is presented along with the slope and intercept values describing the change in validity coefficients associated with increasing quarterly lags (see Table 3). These values may be used to produce a rough estimate of the validity coefficients over longer quarterly lags. For example the estimated validity coefficient for the CALOCUS total score predicting CAFAS total score two quarters

Figure 1. Average validity coefficients with error bars representing ±1 standard deviation and sample sizes for CALOCUS total scale predicting CAFAS 8-scale total scores.

Summary of Correlations for CALOCUS Total predicting CAFAS 8-Scale Total Lagged by Fiscal Quarters

Mean Correlation = -0.04 Quarter + 0.54, R-square = 0.86, t(10) = -7.86 p < .001

	Quarterly Lag											
	0	1	2	3	4	5	6	7	8	9	10	11
Number of Samples	12	11	10	9	8	7	6	5	4	3	2	1
Total Number of Participants	6,890	4,423	3,271	2,363	1,702	1,144	811	536	322	202	84	21
Mean Sample Size	574	402	327	263	213	163	135	107	81	67	42	21
SD of Sample Size	206	150	115	94	58	61	55	48	38	38	24	

later may be roughly calculated by taking the intercept value and adding the slope value multiplied by the number of quarterly lags. Using this method the estimated two-quarter validity coefficient is .46 (.54 - .04 * 2), which overestimates the observed value of .42 (see Figure 1). Alternatively, the estimated ten-quarter validity coefficient is .14 (.54 - .40), which underestimates the observed value of .18 (see Figure 1). Technically, these estimates will be biased to the extent that the linear model does not accurately describe the observed correlations. For some variables, the observed validity coefficients tend to reduce more rapidly over short quarterly lags than longer quarterly lags (i.e., the trends tend to be slightly concave). In this case, the linear method tends to overestimate validity coefficients for shorter lags and underestimates validity coefficients for longer lags.

As is also illustrated in Figure 1, the number of samples decreased with increasing prediction intervals, as did the average sample sizes. Accordingly, the variability (SD) of sample means around the total mean tended to increase with longer prediction intervals. At the extreme prediction lags (e.g., 10 and 11 quarter lags), only one or two samples were available and these often were of small size (e.g., 30 or less). To prevent these extreme conditions from having an undue effect of the estimated linear models, outlier samples that disproportionately altered the interpretation of results were deleted from the linear trend analysis.

Several consistent relationships were evident between the CALOCUS and the CAFAS subscales. The CALOCUS Functional Status, Resiliency, and Risk of Harm were subscales most closely related with the CAFAS, particularly the CAFAS Behavior Toward Others, Home Role Performance, and School Role Performance subscales. The CALOCUS environmental subscales, Environmental Stress and Environmental Support, related most highly with CAFAS Community Role Performance and Primary Caregiver Material Needs subscales, but did not correlated with the Primary Caregiver Family Social Support subscale. Because the CAFAS Primary Caregiver

Table 6. Average one-quarter correlations for CALOCUS scales predicting CAFAS scales with slope and intercept values in parentheses for estimating validity coefficients at other quarterly lags.

CALOCUS	CAFAS										
	Total	Behavior Toward Others	Substance Use	Thinking	Emotions	Self-Harm	Home Role	School Role	Community Role	Social Support Primary	Material Needs Primary
Total	.52 (-.04, .54)	.35 (-.03, .36)	.30 (-.02, .29)	.15 (-.03, .13)	.24 (-.01, .24)	.20 (-.04, .32)	.40 (-.03, .40)	.32 (-.02, .33)	.26 (.00, .26)[a]	.00 (.00, -.01)[a]	.21 (-.01, .24)
Level of Care	.49 (-.04, .53)	.36 (-.02, .35)	.20 (-.02, .19)	.17 (.00, .16)[a]	.25 (-.01, .25)[a]	.19 (-.02, .24)	.42 (-.04, .43)	.33 (-.03, .35)	.27 (-.04, .33)	.02 (.00, .01)[a]	.16 (-.01, .19)
Comorbidity	.33 (-.03, .37)	.16 (-.02, .19)	.21 (-.01, .21)[a]	.25 (-.02, .27)	.16 (.00, .13)[a]	.15 (-.02, .20)	.27 (-.02, .26)	.19 (-.03, .22)	.12 (-.02, .16)	-.02 (.00, .01)[a]	.04 (.00, .04)[a]
Environmental Stress	.25 (-.02, .25)	.14 (.00, .12)[a]	.20 (-.02, .20)	-.09 (.00, -.08)[a]	.09 (-.01, .12)[a]	.02 (.00, .03)[a]	.23 (-.02, .21)	.15 (-.02, .18)	.31 (-.04, .35)	.01 (.01, -.06)[a]	.27 (-.01, .31)[a]
Environmental Support	.18 (-.02, .21)	.13 (-.01, .11)	.14 (-.02, .16)	-.07 (.01, -.09)[a]	.05 (-.01, .06)[a]	.04 (-.01, .06)	.16 (-.02, .17)	.12 (-.01, .14)	.23 (-.02, .24)	-.02 (-.01, .02)[a]	.28 (.00, .28)[a]
Functional Status	.44 (-.04, .48)	.36 (-.03, .39)	.10 (-.02, .12)	.24 (-.01, .22)[a]	.26 (.00, .26)[a]	.21 (-.02, .23)	.35 (-.03, .36)	.32 (-.03, .35)	.13 (-.02, .18)	-.01 (.00, .02)[a]	.07 (.00, .06)[a]
Resiliency	.43 (-.03, .42)	.34 (-.03, .34)	.18 (-.01, .15)	.10 (.01, .05)[a]	.24 (-.01, .23)	.15 (-.02, .18)	.35 (-.03, .34)	.30 (-.02, .29)	.24 (-.04, .29)	.00 (.00, -.03)[a]	.06 (.00, .08)[a]
Risk of Harm	.46 (-.03, .47)	.36 (-.03, .38)	.17 (-.01, .14)[a]	.15 (.00, .15)[a]	.23 (-.01, .24)	.23 (-.02, .27)	.38 (-.02, .37)	.27 (-.02, .30)	.24 (-.03, .28)	.05 (.00, .05)[a]	.07 (-.02, .09)
Child Treatment Acceptance	.35 (-.04, .42)	.26 (-.03, .31)	.18 (-.01, .17)	.10 (-.01, .10)	.19 (-.02, .24)	.09 (-.02, .13)	.29 (-.02, .30)	.23 (-.02, .25)	.21 (-.02, .23)	-.09 (.01, -.10)[a]	.05 (.00, .06)[a]
Parent Treatment Acceptance	.09 (-.01, .11)[a]	.09 (.00, .06)[a]	.08 (-.01, .11)	-.10 (.01, -.12)	.00 (.00, .02)[a]	.05 (-.01, .08)	.06 (.00, .06)[a]	.07 (.00, .07)[a]	.14 (-.01, .17)	.02 (.00, .02)[a]	.16 (-.02, .23)

Note: [a] coefficients were relatively stable across quarterly lags, so the trend was poorly described by a linear model using $\alpha = .05$.

Family Social Support subscale did not correlate with any variable, this lack of correlation is likely due to poor performance of this CAFAS subscale rather than the CALOCUS environmental subscales. Alternatively, the CALOCUS Parent Treatment Acceptance and Engagement subscale demonstrated minimal correlations with the CAFAS scales, except for a small average correlation with the CAFAS Primary Caregiver Material Needs subscale.

Predictive validity analysis also examined the degree to which CALOCUS and CAFAS scores predicted subsequent service utilization. Unlike the correlations between the CALOCUS and the CAFAS, a considerable asymmetry was observed in the predictive validity of these measures and service variables. Notably, the CALOCUS and CAFAS predicted the magnitude of subsequent service utilization better than service utilization predicted subsequent CALOCUS and CAFAS scores. Service utilization variables explained a negligible amount of variance in subsequent CALOCUS and CAFAS scores. Therefore, only the results from analyses examining CALOCUS and CAFAS scales predicting subsequent services are reported.

The pattern of predictive correlations for the CALOCUS and service variables was very similar to the pattern of concurrent correlations between the CALOCUS and service variables, but the one-quarter predictive validity coefficients were somewhat higher than the concurrent correlations (see Table 7). Presumably, this increase was due in part to the use of the CALOCUS in decision-making about the types of services that a youth should receive following their most recent assessment. The magnitude of the predictive validity coefficients between the CALOCUS and service variables did tend to follow a linear trend over time, although this decrease was much less pronounced than for the coefficients between the CALOCUS and CAFAS scales and not all scales demonstrated a declining trend. The CALOCUS total and level of care scales were significantly but modestly correlated with the proportion of out-of-home hours received, the maximum level of

Table 7. Average one-quarter correlations for the CALOCUS scales predicting service variables with slope and intercept values in parentheses for estimating validity coefficients at other quarterly lags.

CALOCUS	Service Variables			
	Total Service Hours	Proportion Out-of-Home	Service Restrictiveness	Total Cost
Total	.03 (.00, .06)[a]	.24 (-.01, .26)	.24 (-.02, .27)	.28 (-.03, .33)
Level of Care	.07 (-.01, .10)	.21 (-.02, .25)	.23 (-.02, .23)	.27 (-.03, .32)
Comorbidity	.11 (-.02, .16)	.08 (-.01, .10)[a]	.11 (-.02, .16)	.15 (-.02, .20)
Environmental Stress	-.09 (.01, -.08)	.20 (-.01, .23)	.15 (-.02, .17)	.15 (-.02, .20)
Environmental Support	-.08 (.01, -.07)	.12 (-.01, .14)	.10 (-.02, .12)	.10 (.00, .11)[a]
Functional Status	.10 (-.01, .11)	.13 (-.02, .20)	.16 (-.01, .17)	.21 (-.03, .26)
Resiliency	.00 (.00, .03)[a]	.18 (-.01, .19)	.18 (-.02, .20)	.20 (-.02, .24)
Risk of Harm	.09 (-.01, .12)	.21 (-.02, .23)	.19 (-.01, .21)	.27 (-.02, .32)
Child Treatment Acceptance	-.01 (.00, -.01)[a]	.13 (.00, .14)[a]	.12 (.00, .13)[a]	.14 (.00, .15)[a]
Parent Treatment Acceptance	-.09 (.01, -.10)	.10 (-.02, .15)	.06 (-.02, .11)	.09 (-.01, .12)

Note: [a] coefficients were stable across quarterly lags and did not show a linear decline using α = .05.

service restrictiveness received, and the total cost of services received in the fiscal quarter following CALOCUS assessment. Of the subscales, Risk of Harm tended to be the strongest predictor of subsequent services.

Table 8. Average one-quarter correlations for the CAFAS scales predicting service variables with slope and intercept values in parentheses for estimating validity coefficients at longer quarterly lags.

CAFAS	Service Variables			
	Total Service Hours	Proportion Out-of-Home	Service Restrictiveness	Total Cost
8-Scale Total	.25 (-.01, .27)	.22 (-.01, .21)	.26 (-.01, .27)	.16 (-.02, .16)
Behavior Toward Others	.20 (-.01, .21)	.13 (-.01, .15)	.20 (-.01, .21)	.12 (-.01, .12)
Substance Use	.02 (-.01, .04)	.18 (-.02, .23)	.09 (-.01, .13)	-.03 (.00, -.04)[a]
Thinking	.18 (-.02, .21)	-.07 (.00, -.08)[a]	.08 (.00, .08)[a]	.08 (.00, .08)[a]
Emotions	.13 (-.01, .12)	.04 (.00, .03)[a]	.15 (.00, .12)[a]	.05 (-.01, .07)
Self-Harm	.10 (.00, .09)[a]	.04 (.00, .02)[a]	.10 (.00, .08)[a]	.09 (-.01, .10)
Home	.28 (-.02, .30)	.25 (-.01, .24)	.28 (-.02, .32)	.20 (-.02, .19)
School	.07 (.00, .10)[a]	.03 (.00, .03)[a]	.10 (-.01, .13)	.01 (-.01, .02)
Community	.15 (.00, .13)[a]	.33 (.00, .27)[a]	.18 (.00, .17)[a]	.18 (-.01, .17)
Material Needs	.03 (.00, .04)[a]	.08 (.00, .05)[a]	.03 (.00, .02)[a]	.01 (.00, .03)[a]
Social Support	-.01 (.00, .01)[a]	.05 (.00, .02)[a]	-.02 (.00, -.01)[a]	-.02 (.00, -.01)[a]

Note: [a] coefficient was stable across quarterly lags and did not show a linear decline using $\alpha = .05$.

As with the CALOCUS, the pattern of predictive correlations for the CAFAS was very similar to the pattern of concurrent correlations between the CAFAS and service variables, but the one-quarter predictive validity coefficients were somewhat higher than the concurrent correlations except for the total cost analyses. Specifically, the CAFAS Home Role Performance subscale yielded somewhat higher average validity coefficients than the 8-scale total score across criterion measures, and the Community Role Performance subscale yielded the highest average predictive validity coefficients for the proportion of service hours provided in out-of-home settings. Two primary patterns were evident in CAFAS validity coefficients across time. The validity coefficients either tended to be small and remain stable across increasing quarterly lags (e.g., Thinking, Emotions, Self-Harm, School Role Performance, Material Needs, and Social Support), or tended to be of larger magnitude over short prediction periods and show a linear decrease as the length of the prediction period increased (e.g., 8-Scale Total, Behavior Toward Others, Home Role Performance). The Community Role Performance subscale was an exception in that it tended to be of relatively larger magnitude, yet remained fairly stable across time.

Incremental Validity

The final set of analyses examined the incremental validity of the CALOCUS and CAFAS total scores in predicting service variables. For the sake of simplicity, only the CALOCUS and CAFAS total scores were included and only predictive lags of one-quarter were analyzed. Separate hierarchical multiple regression analyses were conducted with total hours, proportion of out-of-home service hours, and total cost as dependent variables. Service restrictiveness was not included because of its ordinal measurement property and because other analyses suggested that it behaved similarly to the proportion of out-of-home service hours and total cost variables. Youth gender and age at first assessment were included at the first step in the hierarchy, followed by the CALOCUS and CAFAS total scores. A significant increase in R^2 at the second step indicated that the CALOCUS and CAFAS scores jointly improved prediction of services beyond the demographic variables whereas significant univariate regression coefficients indicated that the CALOCUS or CAFAS made a unique contribution beyond the other variables.

Across dependent variables, joint entry of the CALOCUS and CAFAS led to a significant increase in prediction beyond demographic variables in 100% of the samples examined. The average increment in R^2 for the total hours analyses was .07 and the full models yielded an average shrunken R^2 of .07. The CALOCUS made a significant unique predictive contribution to total hours in 18% of the samples, the CAFAS made a significant unique contribution to 73% of the samples, and in 18% of samples neither measure made a unique contribution.

In the analyses of the proportion of service hours provided in out-of-home placements, the average increment in R^2 was .07 at the second step. The CALOCUS made a significant unique predictive contribution to the proportion of out-of-home hours in 73% of the samples, the CAFAS made a significant unique contribution to 36% of the samples, and in 0% of samples neither measure made a unique contribution.

The average increment in R^2 was .11 at the second step in the analyses of total cost. The CALOCUS made a significant unique predictive contribution to total cost in 64% of the samples, the CAFAS made a significant unique contribution to 82% of the samples, and in 0% of samples neither measure made a unique contribution.

Thus, the CAFAS provided more unique information in the prediction of service intensity, the CALOCUS provided more unique information in the prediction of service restrictiveness (as measured by out-of-home service provision), and both instruments provided unique information in the majority of analyses predicting total costs, which are affected by intensity, duration, and restrictiveness of services.

Discussion

The present paper examined the temporal stability, concurrent, predictive and incremental validity of the CALOCUS and CAFAS scales. Findings indicated that both the CALOCUS and the CAFAS yielded relatively stable scores over short periods and that stability decreased in a generally linear fashion as the time lag between measurements increased. Total scales from both

the CALOCUS and CAFAS were more generally stable than subscales. The CALOCUS total scale demonstrated somewhat greater temporal stability than the level of care judgment. Results generally supported the concurrent and predictive validity of these measures in relation to each other and in relation to service utilization and cost variables.

The CAFAS and CALOCUS provided both common and unique information. The significant correlation between the measures provides an indication of their convergent validity, whereas the unique information suggests a significant degree of discriminant and incremental validity. The CAFAS was more strongly related with service intensity, whereas the CALOCUS was more strongly related with service restrictiveness. As service intensity and restrictiveness are both important cost drivers, both the CAFAS and the CALOCUS were useful in predicting total future service costs. Finally, the CAFAS and CALOCUS measures were better at predicting future service use than service use was at predicting future CAFAS and CALOCUS scores.

Thus, both the CALOCUS and the CAFAS appear to be psychometrically appropriate for use in some decision-making situations. In almost all analyses the CAFAS 8-scale total score and the CALOCUS total score demonstrated the best operating characteristics. Although the present study was not designed to sensitively detect differences between subscales, the fact that the total scores consistently displayed as good or better validity coefficients than the best subscales supports that recommendation that total score interpretation be preferred to subscale interpretation. The exceptions to this recommendation are that the CAFAS Home Role Performance subscale may be preferable for estimating future service utilization and the Community Role Performance subscale may be particularly useful for predicting out-of-home placement. Further, the CALOCUS Environmental Stress, Environmental Support, and the CAFAS Primary Caregiver Material Needs subscales appear to describe an environmental factor that is not as well captured by the total scores.

Several limitations are important to keep in mind when interpreting these results. First, the stability analyses describe the similarity of CALOCUS and CAFAS scores across time in an operating system, but they are not true test-retest reliability coefficients. Because youth were actively receiving treatment, substantive changes were expected in levels of functioning and service needs. This would tend to bias stability estimates toward underestimates of true reliability. On the other hand, youth with significant improvements in functioning were likely to be discharged from the system, so that youth remaining in the longer-term samples were likely to have more stable functioning.

Similar factors are important to consider when interpreting the predictive asymmetry of the CAFAS and CALOCUS in relation to services variables. First, youth who tended to improve over time were more likely to be discharged from services, and therefore less likely to be included at future assessment points. Other analyses examining changes over time have found that the majority of youth receiving services from CAMHD show reductions in CAFAS and CALOCUS scores over time (c.f., Daleiden, 2003). Thus, service provision likely exerts a causal effect that would tend to create a negative correlation with subsequent child status scores. This influence would tend to buffer the positive correlation expected between child status scores and service needs. Also, because the CAFAS and CALOCUS were gathered and available for use in

decision-making regarding services, a causal mechanism may exist that would tend to promote matching of future service use with recent child status scores.

The present study also performed analyses based on fiscal quarters rather than more conventional admission to follow-up analyses. This decision had several implications. The results of these analyses do not reflect the common clinical decision-making situation where a child receives an intake assessment that is used for treatment planning or prognostication. These analyses more directly reflect an administrative decision-making situation where scores from a given quarter are used to estimate average functioning and service utilization. The use of a fiscal quarter as the unit of analysis also led to an imprecise specification of how close in time predictor and criterion measures were administered. Specifically, scores measured one day apart could fall into two different quarters. Similarly, if a youth received an assessment on the first day of one quarter and the last day of the next quarter, a difference of almost 180 days would be represented as two quarters. Although these examples are possible, they represent extremes and not the typical assessment pattern. The consistent pattern of results across quarterly samples and across increasing lags suggested that the findings of the present study are fairly generalizable across the CAMHD population and historical periods examined.

Future analysis using additional criterion measures will be necessary to examine more specific convergent and discriminant validity of subscales (e.g., CALOCUS comorbidity scale in relation to actual diagnostic comorbidity) and to support more in-depth recommendations regarding conditions for preferring each measure in decision-making. Future analysis of the properties of these scales when used as intake assessments for predicting treatment needs (e.g., safety), treatment selection, and treatment response may also be fruitful.

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Author's Note